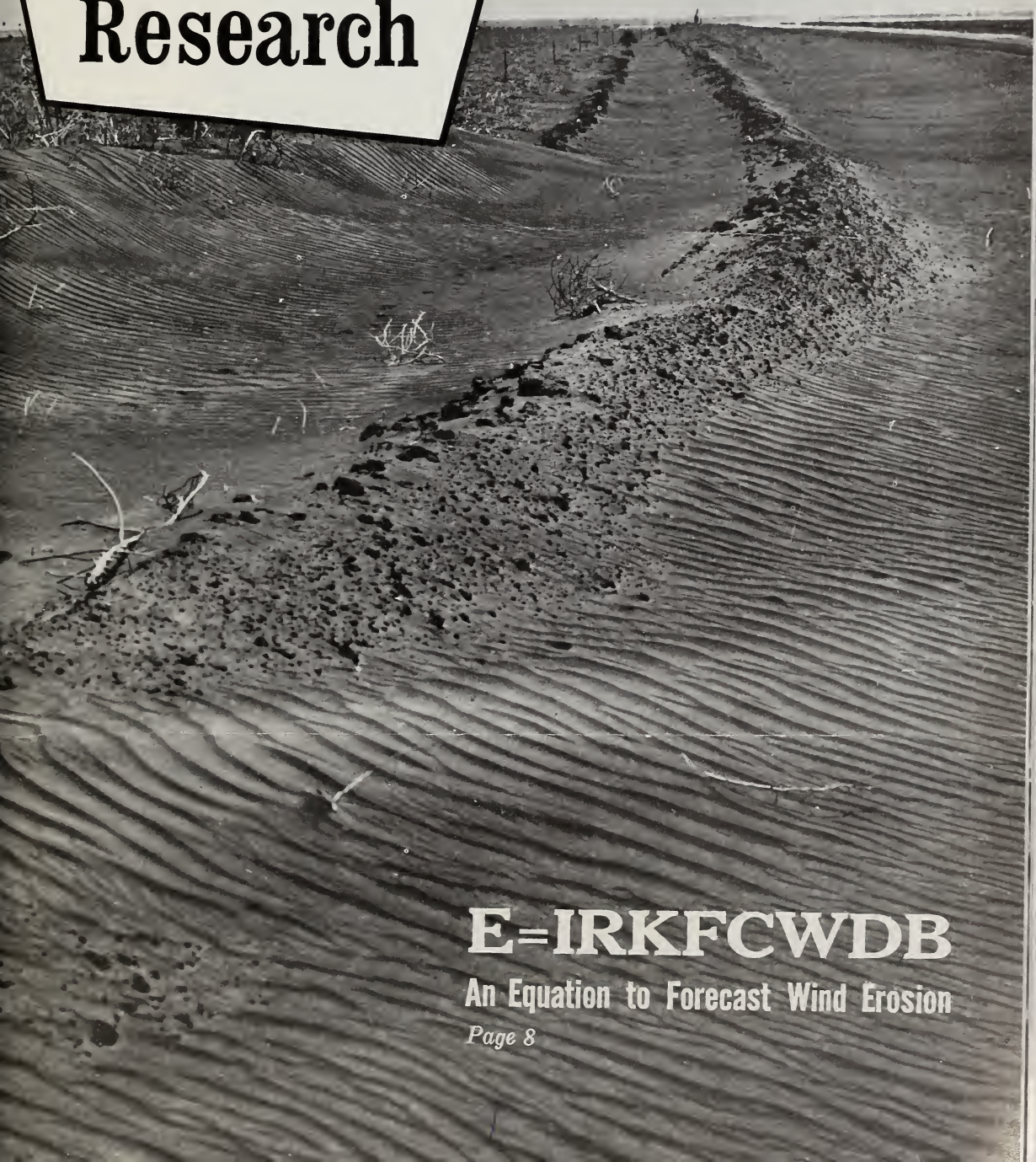
October 1961|U.S. Department of Agriculture

AGRICULTURAL Research



E=IRKFCWDB

An Equation to Forecast Wind Erosion

Page 8

AGRICULTURAL
Research

October 1961/Volume 10, No. 4

Contents

Editor: H. G. Hass. Managing Editor: J. R. Madison. Contributors to this issue: S. S. English, C. E. Olsson, W. W. Martin, D. R. Hemenway, B. R. Blankenship, L. D. Mark, A. H. Miller, W. E. Carnahan, B. P. Smith.

A Beef Roast

Agricultural research is bringing many improvements in food products to nearly every step along the production and marketing line. Take a beef roast, for example:

Research has improved almost everything from the way a roast is packaged and displayed to the grasses eaten by the cattle. And research has given housewives many new guidelines for buying and cooking beef. Investigations continue on new cooking techniques that will preserve tenderness and flavor.

Advances in livestock feeding, management, and animal health make it possible for farmers to produce increasing numbers of healthy, high-quality cattle.

Who are these researchers that concern themselves with putting a tender, flavorful beef roast on your table? They're a team representing diverse specialties. ARS has learned that the greatest progress is made when various scientific disciplines are turned to a common problem. Beef research gets contributions from many groups of specialists.

Biochemists seek better understanding of the role of fat particles in the cells and the relationship between tenderness and the size and elasticity of different muscle fibers.

The task of breeding new lines of cattle that provide beef of superior flavor and tenderness falls to *geneticists.*

Histologists make microscopic studies of animal tissues to serve as a basis for selections for breeding programs.

Livestock nutritionists study relationships between rations, composition of beef, rate of growth, and tenderness. *Animal pathologists* and *parasitologists* work toward healthier stock.

Botanists search for forage crops to provide more nutritious feed for cattle. *Soil physicists* study soils upon which feed crops grow. *Chemists* investigate the composition of grain and forage crops and *engineers* attempt to improve design of farm equipment and buildings.

Biologists and others investigate refrigeration, shipping, and storage problems. *Economists* look for ways to cut production and marketing costs.

Each of these groups of scientists contributes findings; the final result is a better beef roast for consumers.

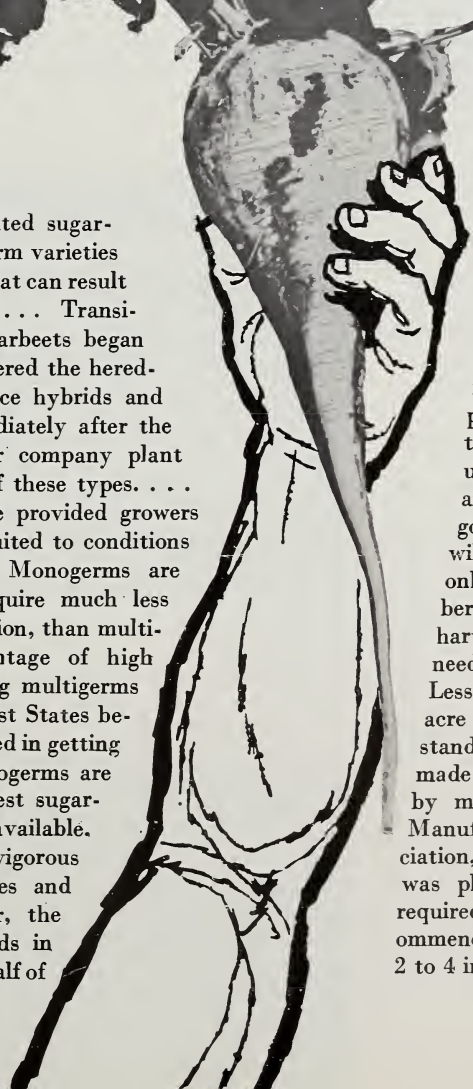
AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D.C. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1 in the U.S. and countries of the Postal Union, $1.50 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington 25, D.C.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Growth Through Agricultural Progress

Efficient application of important discoveries provided the new varieties for . . .

TRANSITION TO IMPROVED SUGARBEETS



■ Rapid replacement of open-pollinated sugarbeet varieties by hybrids, and multigerm varieties by monogerms, is a good example of what can result from efficient use of research findings. . . . Transition to these improved types of sugarbeets began within 10 years after scientists discovered the hereditary characteristics needed to produce hybrids and the single-seeded monogerms. Immediately after the discoveries, USDA, State, and sugar company plant breeders began developing varieties of these types. . . . In the past 5 years, researchers have provided growers with many monogerms and hybrids suited to conditions in different beet-growing districts. Monogerms are especially desirable because they require much less thinning, an expensive part of production, than multigerms. Hybrids provide the advantage of high yields. . . . Monogerms are replacing multigerms (they have many-seeded fruits) in most States because of the costs and difficulties involved in getting labor for thinning. Some of the monogerms are also hybrids. In California, the largest sugarbeet producer, labor has been readily available. So growers there first switched to vigorous multigerm hybrids that resist diseases and produce high yields. Now, however, the move is to the new monogerm-hybrids in California. . . . In 1961, more than half of the sugarbeet acreage, excluding California, was planted to monogerms and monogerm-hybrids. Use of monogerms at presently recommended seeding rates is estimated to reduce by 50 percent the labor for hand thinning. . . . Research underway on seeding rates and cultural practices offers good prospects that growers will eventually be able to drill only enough seed for the number of plants they expect to harvest, thus eliminating the need for thinning altogether. . . . Less than a pound of seed per acre was used to get the desired stand in experimental plantings made in the Great Lakes region by members of the Farmers & Manufacturers Beet Sugar Association, a cooperating agency. Seed was planted 8 inches apart and required no thinning. Present recommended practice is drilling seed 2 to 4 inches apart.

Turn Page

SUGARBEET TRANSITION

(Continued)

USDA is continuing research, with States and industry, to improve monogerms and monogerm-hybrids. All current U.S. monogerm lines are descendants of one plant found in 1948 by ARS geneticist V. F. Savitsky, then a USDA collaborator employed by the Beet Sugar Development Foundation. Crosses of two of these related inbreds produce plants that don't have maximum hybrid vigor, so multigerms are presently used as pollen donors in producing monogerm-hybrids.

ARS scientists, using monogerm lines obtained through exchange with Russia and Poland, are attempting to develop hybrids that are completely monogerm. It's hoped the monogerm lines from abroad, crossed with the U.S. lines, will produce highly vigorous monogerm-hybrids. This research is being conducted by ARS geneticist F. V. Owen, Logan, Utah; plant pathologist J. O. Gaskill, Fort Collins, Colo.; and agronomist G. J. Hogaboam, East Lansing, Mich.

Finding of CMS led to current hybrids

Discovery by Owen of cytoplasmic male sterility (CMS) in sugarbeets opened the way to development of the hybrids we have now. Plants that possess CMS don't produce pollen. This characteristic is used to develop nonpollen-bearing inbred lines as seed parents in crosses. This year, hybrids developed by USDA and industry represented more than 90 percent of the seed crop grown for use in California.

Five of these hybrid varieties were developed by three-way crosses by ARS geneticist J. S. McFarlane at Salinas, Calif. These varieties yield 5 to 20 percent more gross sugar than open-pollinated varieties and resist curly top virus and bolting (premature growth of flower shoots). Bolting is a special problem in the Imperial Valley of California, where sugarbeets are grown as a winter crop. Some of the hybrids, adapted to different growing areas in California, also resist downy mildew.

McFarlane recently incorporated the monogerm characteristic in a hybrid variety, and a limited amount of its seed will be available to California growers next year.

McFarlane believes the three-way cross offers the best possibility for developing hybrid sugarbeets. Here's how it's done:

First, plants are selected for resistance to diseases and bolting, and inbred lines with these characteristics are produced. Next, male-sterile counterparts of these lines are developed through use of CMS.

By crossing the pollen-producing plants of one line with the male-sterile counterparts of another, McFarlane obtains male-sterile F_1 (first generation) hybrids. These are used as the seed-bearing parent in commercial seed production. A pollen-producing line, selected for good combining ability, is interplanted with the male-sterile F_1 hybrids to complete the three-way cross and produce the hybrid seed used by growers.

Sugar company plant breeders also use the three-way cross and McFarlane's inbreds to develop hybrids.☆

Flower of sugarbeet with CMS produces no pollen (left, above) in contrast to normal flower (right). In hybrid seed production (below), CMS plants are grown in 16-row strips interspersed by 4-row strips of pollen-bearing plants. Seed borne on the CMS plants is hybrid.

Plants not retarded by chemicals (left) wilted 24 hours after fertilizer was added to make soil saline. Retarded plants (right) didn't wilt. Same plants (below) 3 weeks after fertilizer was added to the soil.

DWARFED SOYBEANS GAIN SALT TOLERANCE

Growth-retarding chemicals may also produce dramatic unseen changes

■ A soybean plant dwarfed by chemical growth retardants can withstand greater concentrations of salt in the soil than an unretarded plant.

This discovery by ARS agronomists shows that retardants may produce unseen changes within plants as dramatic as the outwardly visible dwarfing effects.

The finding is one result of efforts at USDA's Agricultural Research Center, Beltsville, Md., to learn more about retardants.

P. C. Marth and J. R. Frank treated potted soybeans with Amo-1618 (sprayed on the plants or added in solution to the soil) and with CCC and phosfon (both added to the soil).

When plants visibly responded to the retardants—7 to 12 days after treatment—excessive amounts of 5–10–5 fertilizer were added to the soil to make it saline. Untreated plants were also heavily fertilized.

Treated plants tolerated the salty soil; untreated ones didn't. For example, plants sprayed with Amo-1618 (500 p.p.m.) weren't visibly hurt when 4 grams of fertilizer was added to each 3-inch pot. This is equivalent to almost 8,000 pounds of fertilizer per acre and severely damaged the untreated plants.

Five grams of fertilizer per pot killed *all* the untreated plants, but didn't harm sprayed ones. Retarded plants were killed, however, after 8 grams were applied.

Untreated plants began wilting within 24 hours after fertilizer was applied. Most retarded plants, however, didn't wilt and lived to produce bean pods.

Boosting the strength of the three retardants to 1,000 p.p.m. didn't visibly hurt any of the plants. Five grams of fertilizer didn't injure plants retarded with Amo-1618. Plants treated with phosfon were slightly damaged, but they produced pods. All CCC-treated plants were damaged but most of them recovered. All of the untreated plants died.

Interest in growth retardants stems from earlier studies which show that plants—especially ornamentals—can be dwarfed by these chemicals without injury (AGR. RES., April 1961, p. 10).

Recent experiments, similar to the salt-tolerance study, further illustrate the versatility of growth-retarding chemicals.

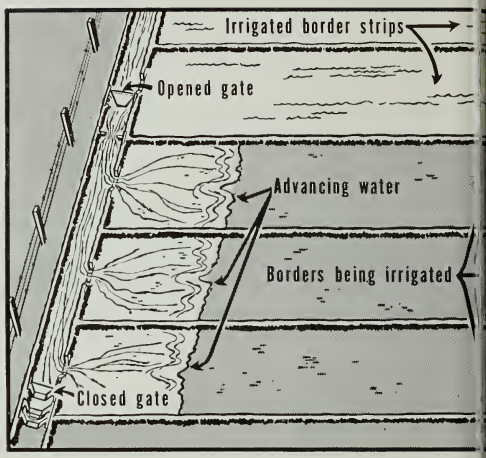
For example, ARS trials show that bean-plant blossoming can often be delayed 3 to 10 days. Bean maturity may be delayed a month following treatment. It's also been noted that retardants lengthen a plant's life—of beans as much as 40 days.

Retardants often impart a deeper green color to leaves, and treated plants usually develop thicker foliage than untreated ones.

Studies so far have demonstrated some of the effects of retardants. But further research is needed before recommendations can be made for practical use of these chemicals—except for the retardants' established usefulness in dwarfing some ornamentals. Questions concerning chemical residues must be answered before these materials can be used on food and feed crops.☆

Closed automatic gate holds back the ditch flow and forces water into the adjacent field borders.

Designers hold test gate in open position. When ditch is filled, the gate rides on the surface of water.



This field arrangement permits three borders to be irrigated before closed gate automatically opens to release water for next group of borders.

AUTOMATIC GATE FOR IRRIGATION DITCHES

Developers of this device—which can open, close, and reset itself—believe it will be especially valuable where water and labor are scarce

■ A new irrigation ditch gate, controlled automatically by waterflow, can reduce labor and increase efficiency of water use.

Placed at proper intervals in a head ditch, gates of this type open in sequence to direct water into field borders or furrows. In ditches that are emptied between irrigations, the gates close and reset themselves for the next irrigation.

USDA agricultural engineers J. A. Bondurant and A. S. Humpherys believe the new gate will prove especially valuable in water-scarce and labor-scarce areas. Savings of water and labor are possible in nearly all irrigation systems. These ARS researchers developed the gate in cooperation with the Idaho Agricultural Experiment Station.

This water-controlled gate is set at right angles to the head ditch and pivots on a horizontal axis at the top. After water is directed into the ditch, the first gate checks the water so that it flows onto the first set of borders.

While these borders are being irrigated, a small amount of water collects in a container attached to the first gate by a trip mechanism. When enough water accumulates, the container descends and releases the trip mechanism. The gate swings up and water flows down the head ditch to the second gate, which repeats the operation cycle. This sequence continues until all fields are irrigated.

When water no longer enters the head ditch and flow ceases, all gates close and relock themselves. Since water in the container is spilled when each gate opens, the entire process is ready to start again when water flows into the ditch.

Irrigation time (and thus the amount of water applied to each border or furrow) is controlled by adjusting the rate of waterflow into the container and by the weight required to trip the release mechanism.

In ditches with little or no slope, several borders or furrow groups can be irrigated by using one gate. In more steeply sloping ditches, however, a gate is needed for each border or furrow group. Furrows may be irrigated individually from spiles set through the ditch bank or by using an equalizing ditch to distribute the water on fields.

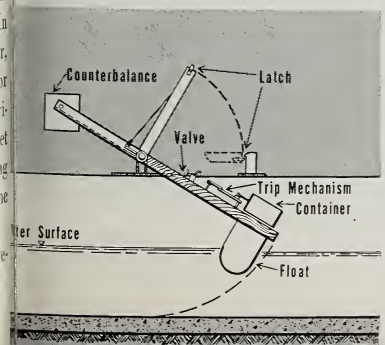
In current practice, a farmer re-

ceives water directly from a canal, or pumps it, into his head ditch. The water is then distributed from the head ditch into field borders or furrows. This is usually done with portable dams, which cause the water to rise in the head ditch. Water flows through openings in the ditch bank or is removed from the head ditch through siphon tubes. After one portion of the field is irrigated, the dams are moved down the ditch so that the next portion of the field can be irrigated.

These operations require much time and work, and farmers often schedule irrigations to fit the farm-labor pattern rather than crop and soil needs. This usually results in inefficient use of water, particularly when the equipment is not moved during the night to irrigate successive borders or furrows. By installing automatic equipment, however, farmers can irrigate efficiently and continuously—and make full use of the water available.

A few farmers have installed clock-controlled dams, which check the water for a given length of time and then release it to the next portion of the head ditch. These timers save water and labor, but must be manually reset before each irrigation.☆

The automatic gate, shown here in opening position, is inexpensive, easy to build and install. It opens, closes, resets itself.



Improved way to gage

Grain Density

■ A simple, accurate means of determining the density of grain—an important step in research aimed at finding a better way to predict the amount of flour that can be milled from grain—has been devised by a USDA scientist.

The new technique will also be used in investigations of the differences between varieties of grain.

This procedure was developed by ARS agronomist E. C. Gilmore with the cooperation of scientists of the Texas Agricultural Experiment Station at Denton.

The means of determining grain density employs the principle of an instrument called an air pycnometer, used by soil scientists to determine the pore space in soils. When a valve is opened between a chamber of pressurized air and an airtight container filled with grain, air pressure drops in the chamber, rises in the container, and becomes equal in both. The decrease in pressure in the chamber is used to determine the volume of air between kernels in the container.

The grain's density can easily be found by subtracting the amount of airspace from the total volume of grain and dividing the difference into the weight of the sample. Density tests by this method seldom take more than a minute.

In the past, the amount of airspace in a sample of grain was determined by pumping air out of the container and replacing it with a liquid. The volume of liquid used to fill spaces between kernels was the same as the volume of air removed. This technique is expensive, time consuming, and usually damages kernels so that they are no longer suited for use in experiments.

Scientists use grain density as an index of starch content. High density indicates high starch content, since starch is more dense than fat and protein—the other chief constituents of grain.

Experiments with the new technique may help millers, who need an inexpensive means of determining starch content. They now use weight per volume unit to predict flour yield from a shipment of grain. This practice is often inaccurate because of the way certain grains pack. One sample may weigh less—yet yield more milled flour per pound—than another sample of equal volume. But the heavier sample brings the highest price, because millers have no other practical way to predict flour yields. Since the new method of predicting grain density is not affected by the way kernels are packed, it may help eliminate this problem.

ARS scientists are testing and refining the modified pycnometer for this and other uses. They are also looking for new applications for the data this device provides.☆

This development should take guesswork out of conservation farming on the Great Plains

AN EQUATION TO FORECAST WIND EROSION

■ Susceptibility of fields to wind erosion now can be measured with considerable accuracy for the first time.

The measuring device is this universal mathematical equation:

E=IRKFCWDB

It was developed by USDA soil scientists for determining wind erosion potential. This equation, used by Soil Conservation Service technicians, county agents, and other agricultural leaders, ultimately should take the guesswork out of conservation farming on the Great Plains and in other areas subject to wind erosion.

The equation is a result of investigations by ARS researchers. They identified factors involved in wind erosion of soil and established ways to measure these factors. Much of the work was done at the ARS Wind Erosion Laboratory, in cooperation with the Kansas Agricultural Experiment Station, Manhattan.

The equation produced from these investigations is a symbolic way of saying that a field's susceptibility to wind erosion (E) depends on eight factors represented by the other letters.

I, SOIL CLODDINESS, is the ratio between nonerodible and erodible soil particles or aggregates.

R, SURFACE COVER, is the resistance to wind offered by crop residue (stubble and growing crops undisturbed by cultivation).

K, RIDGE ROUGHNESS EQUIVALENT, is the roughness or smoothness of the soil surface.

F, SOIL ABRADABILITY or stability, is soil's inherent tendency to erode, as determined by its texture.

(Evaluations of I, R, K, and F were based on wind velocity and surface soil moisture conditions prevailing near Garden City, Kans., in 1954–56.)

C, WIND VELOCITY-SURFACE SOIL MOISTURE, adapts the equation to climatic conditions in areas being considered.

W, FIELD WIDTH, is the tendency of soil movement to increase more or less proportionately with distance downwind, until maximum movement is reached if the field is large enough.

D, WIND DIRECTION, is how the field or strip is oriented in relation to prevailing winds.

B, WIND BARRIER, is the reduction in wind velocity, and consequent reduced erosion, caused by trees, hedges, tall stubble, and crops at right angles to prevailing winds.

After determining how factors involved in wind erosion can be measured with specialized equipment, our scientists devised techniques for estimating some factors in fields.

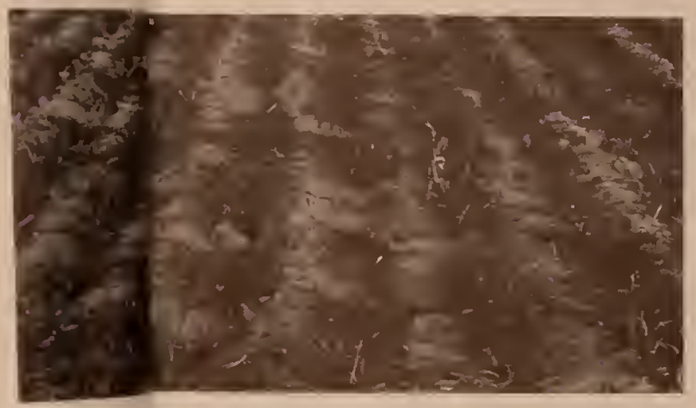
For example, a series of photographs of typical field conditions is available for estimating K and R, ridge roughness equivalent and crop residue. For wind direction (D), ready-reference charts were prepared—reflecting effects of winds striking fields at angles of 1° to 45° from perpendicular. A map was developed, showing wind velocity-surface soil moisture (C) at locations throughout the West.

Scientists emphasize that no technique has been devised which accurately measures *absolute* soil losses caused by wind erosion. Research to more specifically identify the exact role of each factor is continuing. This will result in refinements that should make the equation more useful and versatile.☆

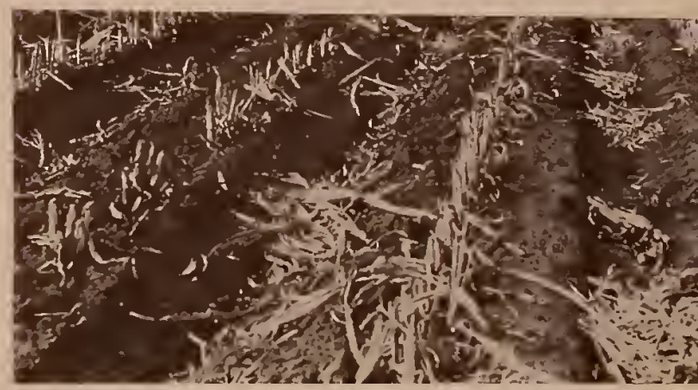
Below are typical examples of low, medium, and high ridge roughness (K) and surface cover (R). The photos are among 18 used to estimate K and R factors in the formula.

1. *Loose, blowing soil containing little residue, is highly erodible. K=1.0 R=312 pounds per acre (low).*

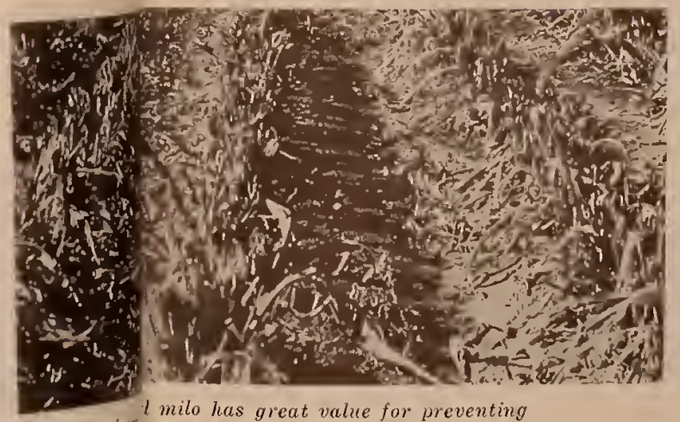
2. *Thin sorghum stubble provides rougher surface but less residue. K=2.5 inches; R=245 pounds (low).*



3. *Some protection covered by wheat and drill ridges. K=3.2 R=779 pounds (medium).*



4. *Stubble from sorghum cut with binder gives moderate erosion resistance. K=4.35 inches; R=575 pounds (medium).*



5. *Stubble from milo has great value for preventing erosion. K=12 R=2,275 pounds (high).*

6. *Lister ridges are high in surface roughness, but residue is very low. K=10.1 inches; R=155 pounds (high and low).*

When a hog producer posts this symbol, his herd is free of swine brucellosis.

A more intensive effort is underway to eradicate this costly disease

Swine Will Be VALIDATED Brucellosis-Free

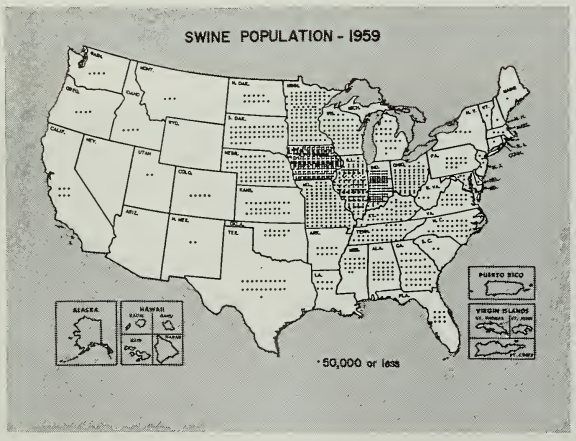
■ Validated Brucellosis-Free Herd—that's a new term hog producers are going to be hearing more about.

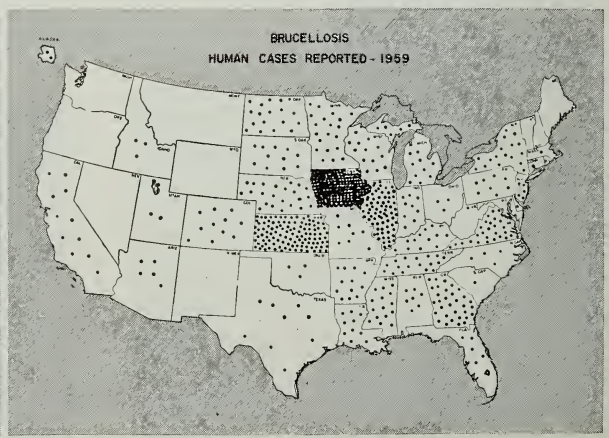
It's going to be widely used in an intensified swine brucellosis eradication effort just begun by the States and USDA. Here's how the program works:

Individual herds are validated brucellosis-free for 1 year, using all procedures recommended by the U.S. Livestock Sanitary Association and approved by USDA and cooperating States. In brief, these procedures consist of two consecutive negative blood tests of each adult animal in a herd. When a herd qualifies, the owner is supplied with an appropriate sign bearing the symbol of validation—identifying his herd as a source of brucellosis-free hogs.

ARS veterinarian C. K. Mingle, who heads brucellosis eradication work, points out that such a herd will be known as a Validated Brucellosis-Free Herd. This new term replaces the designation Certified Brucellosis-Free Swine Herd, which has been used in various State swine brucellosis programs.

"Reason for the change," Mingle explains, "is that hog producers generally associate certified with the production testing certification programs of purebred swine associations—as in Certified Meat Sire and Certified





In the past, most cases of human brucellosis were caused by infected cattle. Now the main source of human infection is swine. In 1959, for instance, more than half of the cases of undulant fever were traced to contact with hogs.

Litter. The word 'validated' is being used to avoid confusion."

About 5 percent of the Nation's swine herds are infected with brucellosis. In some areas, it is estimated that 20 to 30 percent of all herds are infected. Besides costing the swine industry about $10 million a year, this disease is a serious hazard to human health. In the past, most cases of human brucellosis (undulant fever) resulted from *Brucella abortus*, the bovine strain of the disease. But with the marked reduction in bovine brucellosis, the main source of human infection is now *Brucella suis*, the strain commonly found in swine. In 1959, for instance, more than half of the 892 documented cases of undulant fever were traced to contact with swine.

Emphasis first on purebred herds

Eventual eradication of the disease in all swine herds is the goal of the program. However, according to Mingle, major emphasis first will be on validation of purebred herds. These are the source of most breeding boars—and swine brucellosis is primarily spread by infected boars. The disease is also spread by contact with other infected animals or with contaminated feedlots and pastures.

Symptoms include abortions and weak pigs, failure to settle (because of abortions which occur so early they aren't noticed), lameness, and temporary or permanent sterility.

But Mingle points out that farmers can't depend on symptoms as a reliable guide in detecting swine brucellosis. "Symptoms vary—may not appear at all," he says. "So the disease exists in many herds without being suspected."

Mingle warns hog producers not to wait for symptoms. "Regular blood testing of all adult animals in a herd," he emphasizes, "is the only positive way to detect infection."

"There is no effective treatment for swine brucellosis," he adds, "nor can vaccination be used to prevent the disease. While vaccination is important in protecting cattle from brucellosis, no vaccine has been developed to provide similar protection for swine."

Eradication programs exist in 30 States

So a producer's *best* plan is to validate his herd, then purchase boars and replacement breeding stock from other validated herds *only*. Programs for establishing brucellosis-free swine herds now exist in 30 States. In addition, herds in the SPF (Specific Pathogen-Free) program qualify as Validated Brucellosis-Free Herds.

If a herd blood test reveals infection, a producer has three alternate methods of eradicating the disease. Information on these methods—and on the Validated Brucellosis-Free Herd program—is available from State or Federal disease control officials and county agents.☆

Gilt-Only Method Eradicates Swine Kidneyworms

■ Swine kidneyworms were eradicated from heavily infested experimental pastures in three farrowing seasons by using only first-litter gilts for breeding, then removing them after they weaned their pigs.

This simple way to eradicate kidneyworms—parasites that cost hog producers more than $72 million a year—is a result of studies by USDA and Georgia College of Agriculture Experiment Station scientists at Tifton.

The researchers say kidneyworms may require as long as a year to attain egg-laying maturity in swine. A gilt normally weans her pigs and can be disposed of before she starts passing kidneyworm eggs in urine.

All pigs farrowed and weaned on a contaminated pasture by kidneyworm-infested sows had the parasite. Gilts from these litters remained in the pasture until they weaned their first litter. Fewer than half the weaned pigs slaughtered for market had kidneyworms.

The next farrowing season, no kidneyworm damage was found in retained gilts or their young—indicating the parasite no longer infested the pasture.

This gilt-only method of removing kidneyworms should cost farmers little or no more than the conventional practice of retaining older, frequently infested sows for breeding. After three or four farrowing seasons (about 2 years), hog lots will be free of the parasite so that older sows can be used more profitably.

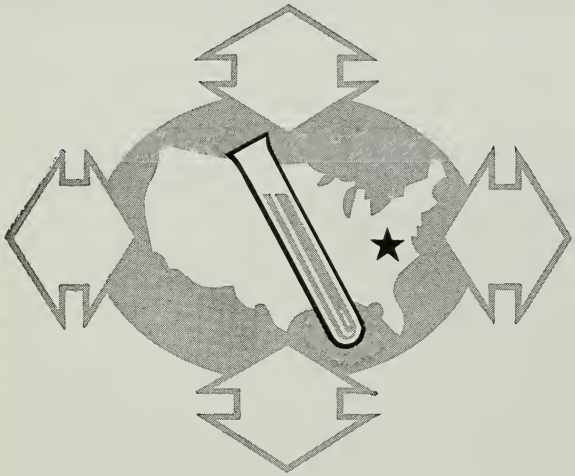
This is the only method ARS parasitologists and Georgia animal husbandmen have found that is effective for ridding farms of the parasite. Most infested areas are in the Southeastern States.

Kidneyworm control with drugs isn't satisfactory because none have been found effective in all areas of a pig's body where the parasite is active—liver, kidneys, kidney fat, loin muscles, central nervous system, and other organs.

Kidneyworm eggs and larvae in a pasture are killed by exposure to sunlight, drying, or unusually high or low temperatures. Larvae not exposed may live 3 to 6 months under trash swallowed by earthworms, which pigs often eat.☆

Geneticists and breeders can confidently use information from analyses of samples, tests made in several countries indicate

Blood-Typing Accuracy Confirmed



■ Any doubts geneticists and breeders may have about the reliability of cattle blood-typing should be dispelled by a recent USDA report on tests made to check the accuracy of such determinations.

Thirteen laboratories in eight countries participated in analyzing samples of the same cattle blood.

Results were nearly perfect when each laboratory tested two unlabeled samples from one animal. Typing was identical for these samples 99 percent of the time.

Agreement among the laboratories was 89 percent when each laboratory typed all the blood samples. More than 75,000 individual tests were performed.

Blood-typing of cattle furnishes valuable information to breeders and geneticists. An animal's blood type is nearly as distinctive as a human's fingerprints, and is an inherited characteristic.

Testing, started in 1956, is conducted by ARS dairy husbandmen C. A. Kiddy and N. W. Hooven at the Agricultural Research Center, Beltsville, Md. Cooperating are laboratories in Belgium, Canada, Denmark, Finland, France, Holland, Norway, South Africa, Sweden, West Germany, and in California, Ohio, Wisconsin, and Wyoming.

Determining blood type in cattle is much more complicated than in humans. It is based on the presence of more than 50 antigenic factors in cattle blood. Antigens are substances that produce antibodies when blood from one animal is introduced into the bloodstream of another (AGR. RES., September 1957, p. 8).

Blood type, determined from the way antigenic factors combine, is controlled by specific genes—indicating an animal's inheritance.

Knowledge of an animal's blood type can be used several ways

Such information is useful to geneticists. For example, there might be a relationship between the inheritance of certain blood types and the inheritance of weight-gaining efficiency or high milk production.

Dairy bulls used for artificial insemination are blood-typed, so breeders can learn the parentage of calves from cows getting semen from more than one sire.

Typing may also be used to determine if twin calves are identical or fraternal. Identical twins have the same blood type.

Fertility of a heifer born twin to a bull may also be indicated by blood-typing. If the twins don't share certain blood characteristics, the heifer is probably fertile. About 93 percent of such heifers—freemartins—are sterile.☆

ANTHRAX CAN BE PREVENTED

■ Anthrax need not be a serious problem of livestock if farmers follow proper preventive measures, according to USDA veterinarian G. B. Van Ness.

This disease, which is one of the oldest and most destructive infections of livestock, can be prevented if animals in contaminated pastures are vaccinated or kept off dry, water-killed grass.

Investigations by Van Ness and other ARS scientists have shown that outbreaks of anthrax occur when animals obtain the disease spores from eating forage grown under a particular combination of soil, moisture, and weather conditions.

Anthrax does not survive on acid soils; only pastures with near-neutral or alkaline soils (pH of 6 or higher) support the bacteria.

In addition, grass and vegetation killed by poor drainage or flooding in the spring are needed for the disease to become active. Anthrax bacteria living on dead or dying vegetation are not dangerous while grass remains waterlogged. Hot, dry weather transforms the bacteria into infectious spores.

Prevention vital if weather aids disease

Preventive measures are vital in seasons of anthrax weather—a wet spring, with much grass-kill, followed by late summer and early fall dry periods, with temperatures continually 60° F. or above.

Water-damaged grass and vegetation are easily recognized. Stream banks and pond margins, where high water kills grass, and marshy pastures and grassy potholes in which water stands may all support anthrax. Another source of spores is moss that covers boulders in streambeds of limestone regions.

Water-kill areas and farm ponds should be fenced off. Ponds and conservation terraces should be constructed to avoid grass-kill from standing water. Grass from water-kill spots should not be harvested for winter feeding as dry hay.

Panic selling and hysteria when anthrax appears in a district, even during anthrax weather, is unwarranted, Van Ness says. Initial spread of the disease is from pasture to animal. Animal-to-animal spread is important only when hogs and other meat-eating animals have access to anthrax-contaminated meat.

Prevention of spread after an outbreak requires burning or deep-burying of infected animals, burning of bedding, and disinfection of quarters with 5-percent lye solution.☆

Hot Weather May Interrupt Cows' Estrus Cycles

■ A cow's estrus cycle can be interrupted by prolonged hot weather. This finding by USDA scientists helps explain why it's often difficult to get cows bred during midsummer.

This is the first time researchers have proved that high temperature—without an accompanying decrease in animals' feed intake—can stop cows' heat periods.

The study by ARS animal husbandmen James Bond and R. E. McDowell also illustrates the remarkable ability of animals to adapt—by shedding their hair—to constant hot weather.

In the experiment, six heifers were subjected to a continuous temperature of 90° F. in a controlled-environment chamber for 7 months. In five animals, estrus cycles stopped after 5 weeks. Their ovaries remained partially active, however. Follicles formed, but didn't mature or discharge eggs.

The test animals' feed consumption was comparable to that of similar heifers kept in a barn during the December-to-July trial. These groups gained about half a pound daily on a pelleted, high energy-low fiber ration. Bond and McDowell made the study at the Agricultural Research Center, Beltsville, Md.

All the heifers adjusted to the artificial environment. Their heat periods were re-established by the fifth month. Then they were bred; five conceived and remained pregnant, although they stayed another 2 months in the 90° chamber.

The cycle interruptions occurred when rectal temperatures, water consumption, and respiration rates were highest. These rates began dropping, however, as the heifers started shedding hair. After 4 months, these rates were nearly normal—and the animal's hair coats were very slick and thin.

Animals in poor condition don't shed much hair during hot weather; nor do they shed hair as quickly as thriftier, well-fed cattle, according to Bond and McDowell. The researchers suggest that removing the winter coat of cattle by clipping would aid their adjustment to the onset of hot weather in the spring.☆

To determine amount of energy used by this woman, researchers equipped her with an 8-pound respirometer to collect and measure air she exhaled.

When Doing Household Chores, Should Women . . . SIT or STAND?

In tests, they used more energy if seated during brief work periods

■ The popular theory that a homemaker can save energy by doing some of her work sitting down is being questioned by USDA scientists.

In laboratory tests, ARS home economists found that women actually used more energy sitting than standing to wash dishes, iron, roll out dough, and lift things from a kitchen counter to shelves above.

They worked at each job for 4 minutes. Many household tasks don't require spending a long time in one place, and in homes with small children even long jobs like ironing are apt to be interrupted.

But before the researchers can determine whether it's most advantageous to sit or to stand for various jobs, they need to find answers to several other questions. For example: Does saving energy eliminate fatigue? How does habit affect the amount of energy used? Do these findings for short work periods also apply to longer work periods?

These studies by nutrition specialist Martha Richardson and physicist E. C. McCracken are part of long-range research on energy use. They are providing basic information used in planning kitchens and other work areas in the home and in developing better methods of doing housework.

Washing dishes and ironing each take 4 percent more energy when done sitting down than when done standing, the studies showed. And this doesn't include getting on and off a kitchen stool. When this energy was added to that expended while sitting to wash dishes, the researchers found that the women used 13 percent more energy to do the job sitting than to do it standing.

The women used 9 percent more energy to roll out dough when sitting than when they were standing. Lifting things from a kitchen counter to shelves above from a sitting position took an average of 6 percent more energy for a 1-pound object, and 4 percent more for a 5-pound object, than it took when standing.

The researchers emphasize that though these findings appear to favor standing for brief tasks to save energy, there are many other considerations in deciding whether to plan workspace in the kitchen or elsewhere in the house for sitting or standing. For example, many people with physical weaknesses or disabilities *have* to sit while working.☆

Worm tissues lived weeks in vitro

Tissues from swine roundworms (helminths) have been kept alive 7 weeks in test tubes. This unique accomplishment by ARS parasitologist D. J. Doran provides a way to study the metabolism of parasitic tissue. From such studies may come better ways to combat animal parasites.

His proof that roundworm tissues can remain alive and bacteria-free in test tubes also means studies may now be made to see if viruses will multiply within parasite cells. If so, the question of whether viruses can be biologically transmitted by internal parasites may be answered.

Most roundworm tissue—intestinal and uterine—died after 4 or 5 days. Tissue taken from the tip of the worm's ovary, however, remained viable 46 to 49 days.

Doran, at USDA's Parasitological Laboratory, Beltsville, Md., proved the cells were alive by using a neutral indicator, phenol red, in the nutrient medium. The indicator turned a yellowish orange as the metabolizing cells produced acids, causing the pH (degree of acidity) to change.

Substitute sprays for mosquitoes

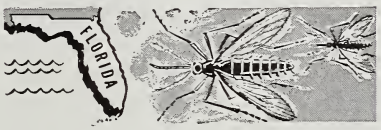
If malathion sprays ever cease to give satisfactory mosquito control along the Florida coast, USDA entomologists will have other tested, effective insecticides to recommend.

An alternative spray for malathion is particularly desirable, since mosquitoes have twice developed resistance to insecticides. DDT became ineffective about 1950. It was replaced by benzene hexachloride (BHC), which ceased to give satisfactory results 5 years later.

Malathion, widely used against adult salt-marsh mosquitoes since 1955, still gives excellent control. It is among the safer insecticides.

ARS entomologists A. N. Davis and J. B. Gahan used malathion as the standard for comparing mosquito-control chemicals. Of 53 chemicals tested in the Orlando, Fla., laboratory, 15 were sufficiently effective to merit field testing.

Six chemicals were more effective against adult *Aedes taeniorhynchus* (Wied.) mosquitoes than malathion under laboratory test conditions. One carbamate compound was six



times as effective, and five organophosphorus compounds were up to three times as effective as malathion.

One of the six most effective materials tested, Dibrom, is less toxic to mammals than DDT, which is considered relatively safe. Others could not be safely used in all situations or would require safeguards.

None of the compounds tested completely meets the desired standards of effectiveness and safety. But several could be used if mosquitoes develop resistance to malathion.

Meanwhile, the search for more useful insecticides continues.

Life of home appliances estimated

A new refrigerator or an electric or gas range can be expected to serve its original owner an average of 16 years, according to estimates of USDA household economists.

However, a family that buys a used electric refrigerator or range keeps it an average of 8 years and a used gas range about 9 years.

To help families plan their long-range finances, the researchers of the ARS Institute of Home Economics prepare such estimates from data obtained for them in special Census Bureau surveys. The figures are also used by manufacturers and distributors of home furnishings.

A new television set serves the original owner an average of 11 years, while a used set serves the buyer 6 years. A family keeps a new electric sewing machine an average of 24 years; a used one, 16 years.

A new automatic toaster serves the original owner 15 years; a used one, 8 years, the estimates show.

In the case of new washing machines, no matter what type a family purchases—automatic, semiautomatic, wringer type, or spin-dryer type—it's kept an average of 9 years.

Facts offered on needs in shelter

Necessary facts on stockpiling food and water in homes and fallout shelters for survival after a nuclear attack are discussed in a new USDA publication.

It tells how much and what kinds of canned and other tightly sealed foods to store, and gives details on sources of safe water in the home and on how to purify and store water.

Sample menu plans show how to provide a reasonably balanced diet from recommended foods. The publication tells how often to replace these foods and lists equipment needed for emergency cooking.

A nuclear attack would probably force many survivors to rely on their own food and water reserves for up to 2 weeks. People are urged to:

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON 25, D.C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

(1) Build up regular food supplies so there is always a 2-week reserve on hand; or (2) store a special emergency supply of food and water in the home or fallout shelter.

Single copies of *Family Food Stockpile for Survival* (HG–77) are free from the Office of Information, U.S. Department of Agriculture, Washington 25, D.C.

Spinaches remain free of mildew

Thirteen years of research by USDA and State scientists have led to the development and release of the only spinach breeding lines anywhere that have remained immune to the two known races of downy mildew.

Commercial hybrids, varieties, and lines developed with this germ plasm have remained immune even in areas where downy mildew wiped out susceptible plants in nearby fields.

Downy mildew is one of the most serious fungus diseases of spinach. It causes leaves to curl, turn yellow, and plants eventually die. Treatment of plants with fungicides is not always practical or successful.

The search for downy mildew immunity began in 1948 when California Agricultural Experiment Station workers found that two primitive wild spinach strains from Iran were immune.

Using germ plasm from the Iranian strains, horticulturist H. A. Jones and plant pathologist R. E. Webb of ARS developed some 76 breeding lines, all immune to both races of downy mildew. These lines are used primarily for crossing with other lines or varieties to produce hybrid spinaches that are also mildew immune. One breeding line was released in 1957 as the variety Dixie Market.

The Iranian strains have two genes that give immunity. One gene gives immunity from one race of downy mildew, the other gives immunity from both races. The latter gene has been bred into the USDA releases.

Since 1955, ARS in cooperation with the Texas and Arkansas Agricultural Experiment Stations also has developed and released several mildew-immune hybrids. Two of them are Early Hybrid 424 and Early Hybrid 425.

The California scientists working on this cooperative research are horticulturist P. G. Smith and laboratory technician A. M. Millett.

Downtrend of two related diseases

Cases of undulant fever in human beings and brucellosis in cattle, diseases caused by the same organism, have declined since 1947.

That year, 6,321 people had undulant fever. Only 892 had the disease in 1959, according to the U.S. Public Health Service.

USDA figures on brucellosis show 4½ percent of all American cattle were infected in 1947, compared with 1½ percent in 1959.

The blood agglutination and milk ring tests, calfhood vaccination, and the market cattle testing program have brought about significant gains in the Federal-State brucellosis eradication campaign.

Contact with infected cattle, swine, and goats—or with products from infected animals—can cause undulant fever in humans.

Spinach leaf (left) is from plant immune to both races of downy mildew. Other leaf is infected by disease. Our spinaches were made immune to this fungus disease by breeding in a gene found in two wild Iranian strains.

U.S. GOVERNMENT PRINTING OFFICE: 1961